The U.S. Army's Response to Chemical Warfare, 1915-1917

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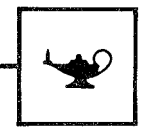


Most of the information Americans received concerning the war and chemical warfare in Europe came from the news media. Because the Royal Navy had cut the German trans-Atlantic cable early in the war, almost all news from the Continent flowed through British and French censors.

According to one author of a study on chemical warfare, Frederick Brown, Allied control of chemical warfare information to the United States can be divided into four distinct phases. During the first phase the Germans were portrayed as violators of the Hague Convention. Reports indicated that the German Army had introduced a barbaric and inhumane weapon. This line, of course, was geared to gaining support and perhaps intervention by the United States on the side of the Allies in the European war. When the French and British decided to retaliate with gas, the message changed, with Allied releases indicating that the German's first use of gas justified retaliation and the reluctant employment of similiar weapons by the Allies. A note of righteous indignation pervaded these reports, although the reports were toned down considerably when discussing the effects of gas. In the third stage, which occurred during the spring and summer of 1917, there was a total news blackout on information concerning the gas war. Assistant Secretary of War Benedict Crowell speculated on the cause. He acknowledged an increased use of chemical agents on both sides and believed the Allies "feared and perhaps with reason" that a picture of gas warfare, if presented to the Americans, would result in a "unreasonable dread of gases on the part of the American nation and its soldiers." The fourth and final phase, which came after U.S. entry into the war, was ushered in with a burst of information with virtually no censorship. The use of chemicals in this phase was depicted as a triumph of Allied technology, an example of good overcoming evil.[1]

Restricted Allied propaganda during the first three phases mentioned above impeded U.S. preparedness in chemical warfare in two ways. First, it gave U.S. officers the impression that the belligerents were making minimal use of gas and that chemical weapons, when employed, had little or no impact on the battlefield. Second, it created the perception among Army officers that chemical warfare, introduced by the barbaric Hun, was inhuman and somehow sullied the honor of the professional soldier.[2]

There were other reasons for the military's lack of appreciation of this new weapon. President Wilson's efforts to maintain strict neutrality during the first two years of the war hampered the Army's planning for defense. When, at one point, Wilson discovered that the General Staff's War College Division had prepared contingency plans for a war with Germany, he reprimanded Secretary of War Lindley Garrison. When the Army did tackle the problem of preparedness, chemical warfare, because it was an unfamiliar subject to most planners, received little attention. Other matters seemed more pressing. There were, for example, significant shortages of all kinds of war materiel. In 1915, the U.S. Army had only twenty-one aircraft, as compared to Britain's 250 and France's 500. The United States had fewer than 700 3-inch guns, while the French alone had 4,800 of a similar caliber prior to the outbreak of war. Based on Western Front usage, the U.S. Army had only a two-day supply of artillery shells. Similarly, four days of trench warfare would exhaust the U.S. inventory of small arms ammunition. In the assignment of priorities to overcome these and other deficiencies, chemical warfare came nowhere near the top of the list.[3]

During the summer of 1915, the U.S. Army War College published studies on the impact of the war on each belligerent's industrial base. In this report, the implications of chemical weapons and gas warfare received no notice. In November, 1915, two months after the British retaliated with gas at the Battle of Loos, the War College published a supplement to the earlier studies. This report included a survey of developments in weapons, equipment, and force structuring, but interestingly, still did not mention gas warfare.

Even the preparedness movement and the passage of the 1916 National Defense Act did nothing to spur an American assessment of the chemical war being waged in Europe. In fact, during Congressional hearings over preparedness for national defense, poison gas was mentioned only once when Col. Charles G. Treat of the U.S. Army's General Staff testified on the subject of changing artillery doctrine in Europe. Following a discussion of shrapnel shells, one Senator asked Treat, "Are they still using the poisonous gas over there, Colonel?" Treat replied, "The papers say so, but we have not had any actual reports from our observers that they are using them." In November, 1916, the same month that Treat testified, the War Department's Board of Ordnance and Fortifications noted that "certain practices" with poison gas in the European war made necessary the procurement of appropriate defensive equipment, such as gas masks for the Army. The board observed that no branch of the U.S. Army then handled anything remotely connected with chemical warfare.[4]

The board, in its final report, recommended that responsibility for the design, but not the supply, of gas masks be given to the Army's Medical Department. In reviewing the records of the board, the Adjutant General sent extracts of the comments that pertained to gas defense equipment to the Surgeon General, who concurred with the board's findings. The Chief of Staff also concurred, after which the Secretary of War gave the Surgeon General responsibility for the development and design of gas masks. No

decision was made as to which branch of the Army would supply troops with protective gas equipment.[5]

The Surgeon General had detailed a number of medical officers to serve as observers with the French and British armies. Reports on the medical aspects of the European conflict, including the diagnosis and treatment of gas victims, were received by the Surgeon General from 1916 on. Unfortunately, for unexplained reasons, the Surgeon General took no action to initiate the development of protective gas devices. The Adjutant General, for his part, shelved the entire matter. Thus, on the eve of American intervention, the Army acted as if it had barely heard of chemical warfare.[6]

The Secretary of War's *Annual Report* for 1917 reflected this neglect. The report pompously declared that the "councils of prudence and forethought" should prepare the Army to surprise the enemy rather than lag "defensively behind the surprises which he prepares for us." The Secretary went on to acknowledge the tremendous impact of science on the war in Europe and referred specifically to the introduction of the airplane and the submarine. As for chemicals, he merely noted that there were other "scientific novelties" that had surfaced in the European conflict.[7]

In February, 1917, the question of the "scientific novelty" called poison gas was finally raised by an anxious Quartermaster General who pointedly asked the Adjutant General exactly which bureau of the War Department would furnish the Army with gas masks if the need arose. The question prompted the Adjutant General to initiate correspondence with the Chief of Ordnance, the Quartermaster General, and the Surgeon General to decide on the responsibility for gas mask production. At the time of the correspondence, the Surgeon General had yet to begin a program of gas mask development.[8]

That same month the Department of Interior's Bureau of Mines took the first positive steps toward preparing the Army for chemical warfare. The director, Van H. Manning, displayed a great deal more vision and foresight than did his military colleagues in Washington. At a bureau meeting, Manning asked his department chiefs what they could do to be useful if the nation should become involved in the European war. Since its founding in 1908, the bureau had investigated poison gases found in mines, conducted research on breathing devices, and examined ways to treat miners who had succumbed to noxious fumes. Obviously, this work had a direct application to chemical warfare. The day following the meeting, the Secretary of the Interior authorized Manning to contact another civilian organization, the Military Committee of the National Research Council. In a letter to C. D. Walcott, the chairman of the committee, Manning pointed out that the bureau could adapt for military application a self-contained breathing apparatus then in use for mine rescues. Also, the bureau had a test chamber at the Pittsburgh, Pennsylvania, experimental station that could be used to conduct tests on military gas masks then in use by the Europeans. The bureau hoped that the information obtained from this research could be

given to the Army, allowing it to adopt the best gas mask, should the need arise.[9]

Upon receipt of this letter, Walcott arranged a meeting between representatives of the General Staff's War College Division and the Bureau of Mines. The meeting proved productive: at the end of February, 1917, the War Department accepted the bureau's offer of assistance and agreed to furnish the support, exclusive of funding, necessary to move the work along. Still, no immediate action was taken by either the Army or the Bureau of Mines to begin a defensive gas equipment research program.

On 6 April 1917, when the U.S. declared war on Germany, the Army not only lacked defensive equipment for chemical warfare, but also had no concrete plans to develop or manufacture gas masks or any other defensive equipment. Even if gas masks had been available, the Army would have had no idea how to conduct defensive gas training. Moreover, no one in the nation seemed to have any practical knowledge concerning offensive chemical warfare equipment or the doctrine then used by the Allies and the Germans for its employment.

Even after the declaration of war by Congress and the decision to ship an American division overseas, preparations for chemical warfare lacked a sense of urgency. The same day war was declared, the Council of National Defense formed a Committee on Noxious Gases. The group met in Washington and immediately adjourned to study British and French gas warfare literature. At later meetings the committee established definite guidelines for Bureau of Mines research to follow in the development of masks. Only then did the chemists at the bureau's Pittsburgh experimental station begin in earnest to develop an American gas mask. The committee also recommended that gas mask production be kept separate and distinct from research.[10]

In May, 1917, the General Staff awoke to the fact that the division requested by the French and British as a token force might well be in combat in a matter of months without any defensive gas equipment. Maj. L. P. Williamson, liaison officer between the Bureau of Mines and the War Department, received a directive from the General Staff telling him to seek the bureau's assistance in the manufacture of 25,000 gas masks. George A. Burrell,* a civilian chemist in the bureau's Research Laboratory, "readily and willingly accepted" the task, but not, as he later noted, "fully appreciating all the conditions which a war mask had to encounter." Burrell should not have been so hard on himself. No one in the United States really understood or even knew much about the employment of chemical defensive equipment on the battlefield.[11]

Working day and night, employees of four different civilian companies fabricated 20,088 masks and filters, using a British Small Box Respirator (SBR) as a model. The masks were shipped overseas to be examined and tested by British experts. They were quickly rejected. The British cabled

*Burrell was made a colonel in the Corps of Engineers and later served in the Chemical Warfare Service Research Division.

back that the masks were unacceptable for combat because the mouthpiece was too large and stiff. They also found the rubberized cloth facepiece did not filter out the agent chloropicrin, which was then being used by the Germans in increasing quantities. The filter, which was worn on the chest in a container, had soda-lime granules that were too soft. With repeated jolting, the granules would clog the canister and increase resistance to breathing.

While this was going on, the acting Chief of Staff, Maj. Gen. Tasker Bliss, after a lengthy round of memoranda initiated by the Adjutant General, informed the Surgeon General on 16 May 1917 that, in addition to research and development, the Medical Department would be responsible for supplying the U.S. Army with gas masks and other defensive equipment. During the next fiscal year the Medical Department would be responsible for supplying 1,000,000 gas masks, 8,500 decontamination sprayers for use in trench warfare, and 1,000 oxygen resuscitators for the treatment of chemical casualties. Unfortunately, neither the Chief of Staff nor the Surgeon General created an office to procure the equipment. The Surgeon General did, however, assign an officer to the National Research Council's Committee on Noxious Gases.[12]

The Committee on Noxious Gases soon met with representatives from the Army and Navy and with members of a French scientific mission. After several sessions, the committee sent a memorandum to the Secretary of War on 2 July 1917, informing him that it had worked out a partial organization plan for a "gas service." Unfortunately, the use of the term "gas service" was misleading, because what the committee recommended turned out to be a cumbersome decentralized system for preparing the Army for chemical warfare. The offensive aspects of gas warfare, the committee explained, should be handled by the Ordnance Department, the defensive measures by the Medical Department. The Bureau of Mines would continue to direct research, and the Corps of Engineers would receive responsibility for handling all chemical warfare material on the battlefield. The General Staff immediately put this decentralized system into effect.[13]

On 24 July 1917 the Chief of Staff ordered the Medical Department to provide nine officers as instructors for a Gas Defense School to be organized at the Infantry School of Musketry, Fort Sill, Oklahoma. As a result of this order, the Medical Department received the additional responsibility for the conduct of defensive gas training. Medical officers with absolutely no experience in gas warfare were now expected to train other medical officers for duty as instructors for an Army that would eventually be expanded to over three million men.[14]

After an interminable delay, the Surgeon General on 31 August 1917 finally created a Gas Defense Service composed of three sections: Field Supply, Overseas Repair, and Training. He placed a Medical Corps officer in command and filled his staff with members of the Medical Department's Sanitary Corps.* The officers had no chemical warfare doctrine to guide

*The Sanitary Corps is equivalent to today's Medical Service Corps.

them. Only two War Department publications existed in the United States to assist these gas officers: a hurriedly compiled *Notes on Gas as a Weapon in Modern War* and a *Memorandum on Gas Poisoning in Warfare.* Both publications appear to have borrowed extensively from French and British gas warfare doctrine, some of it outdated.[15]

The creation of a Training Section, even with its limited expertise, came none too soon. In September, 1917, draftees, volunteers, and National Guardsmen began to arrive at the thirty-six training cantonments scattered across the country. Sanitary Corps and division medical officers, with only several thousand masks at their disposal (including the 20,088 rejected by the British), faced the overwhelming task of training hundreds of thousands of troops in gas warfare and gas defense. Shortages of equipment, manuals, and knowledge were not the only problems facing the new gas officers. Gas was such a new weapon that division commanders and their staff officers were unwilling to give up training time for chemical defense at the expense of more traditional military skills such as close order drill and marksmanship. It was a wonder that any defensive training in gas warfare took place. Many times it did not. Initially, there were at best one or two hours of gas defense lectures, sometimes accompanied by a demonstration of how to wear the gas mask.[16]

The lack of knowledge and experience with gas bred "ignorance and superstition" among recruits and veterans alike. Rumors swept through the camps that Germany had "a gas that would make [soldiers'] eyes drop out of their sockets or their fingers and toes drop off." To the unsophisticated youths who filled the training camps, "gas was mysterious enough, but add to it the word chemical, and it became hopelessly beyond . . . their conception." Gas was such an "intangible thing," a division commander noted, that a level of understanding adequate to guard against the dangers it posed was difficult to reach. Reaching such a level continued to be a hopeless task because no coherent U.S. gas warfare doctrine existed. As a consequence, a majority of World War I doughboys found themselves in a chemical combat environment with only a minimal amount of defensive gas training and with "no idea of what this training really meant."[17]

Confronted with this unfortunate situation, the War College of the General Staff examined the evolving gas defense program in the fall of 1917. Defensive training in gas warfare—regardless of how rudimentary—had to be given to men going to Europe. Ypres had proved what chemical warfare could do to unprepared soldiers. Severe casualties and battlefield defeat might well occur if immediate steps were not taken to train men in the defensive aspects of chemical warfare. As a result, the War College requested and received a British gas officer and a gas NCO for each of the thirty-six training cantonments.

In late October, 1917, the British gas experts arrived in the United States. Their activities were coordinated and directed by Maj. S. J. M. Auld, Special Brigade, Royal Engineers.* Auld quickly made his presence felt. Impressed

*The British Special Brigade of the Royal Engineers was an offensive gas unit. (See Chapter 2.)

by the British gas officer's knowledge and practical experience, the War College and the Field Training Section asked him to prepare "a working textbook on gas" in order to fill the U.S. Army's doctrinal void in chemical warfare. Working with Sanitary Corps Capt. James H. Walton, Auld wrote four pamphlets that were later combined as Adjutant General Document 705, *Gas Warfare.* They were initially published individually in the following order:

Part Three: *Methods of Training in Defensive Methods*

Part Two: *Methods of Defense Against Attack*

Part One: *German Methods of Offense*

Part Four: *The Offensive in Gas Warfare—Cloud and Projector*

Thus, British gas warfare doctrine edited by the War College Division of the General Staff became U.S. Army doctrine.[18]

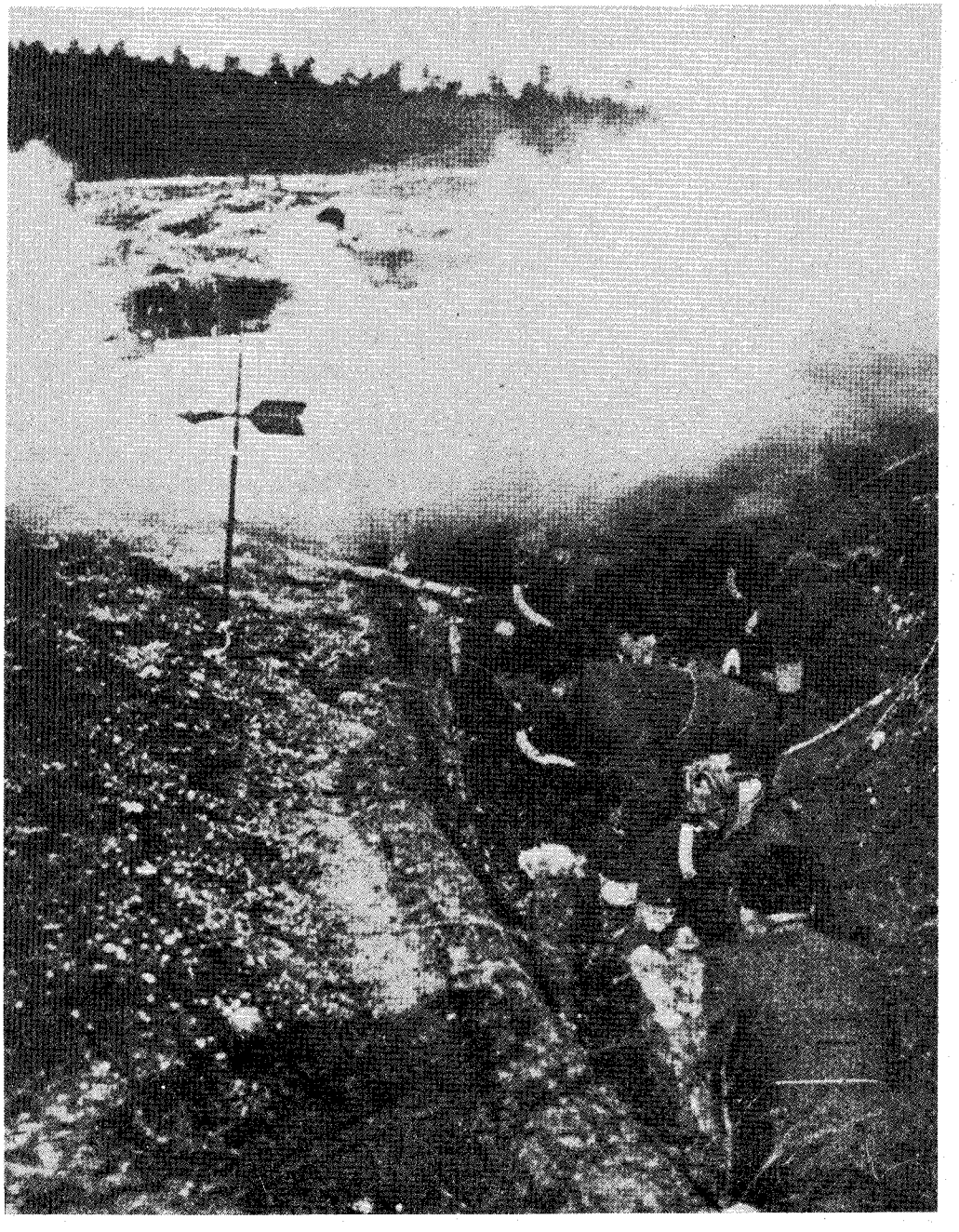
Auld strongly influenced the organization of the U.S. Army for chemical warfare in one other way. When he and other British officers discovered that the General Staff had placed defensive training under the Medical Department, they were appalled. The British officers insisted that gas defense was "purely a military affair"; in their opinion, proper defensive measures were "largely a question of discipline." Based on the experience of the British Army, such procedures were so closely connected with the soldier's "fighting activities" that preparation for chemical warfare could not be carried out by a noncombat branch of the Army. The British were so emphatic that, in January, 1918, by order of the General Staff, the Field Training Section of the Sanitary Corps passed to the Corps of Engineers.[19]

Major Auld also suggested the establishment of a Central Army Gas School to train "Divisional, Brigade and Regimental Gas officers and other personnel whom it might be desirable to educate in Gas Warfare." This idea was already under consideration by the General Staff. The result was the establishment of an Army Gas School at Camp A. A. Humphreys, Virginia,* where in May, 1918, two initial courses began. The first, a four-day course for officers and noncommissioned officers, provided general information on gas warfare. The second, a twelve-day course, was for Chief Gas Officers who would be assigned to division and higher echelon staffs. Although there were similarities between the two courses, the Chief Gas Officers' instruction went into greater detail on most matters. The shortage of trained gas officers in the AEF prevented students from being held for longer periods of field training on subjects such as gas detection, construction of gas-proof dugouts, and the proper wearing of respirators.[20]

Auld assisted in training the first U.S. gas officers, forty-five first lieutenants, all chemists, who were assigned to the Field Training Section of the Sanitary Corps.**The instruction took place at the American University

*Later, in October, 1918, the Army Gas School was moved to Camp Kendrick, adjacent to Lakehurst, New Jersey, the proving ground for the new Chemical Warfare Service established on 11 May 1918.

**In January, 1918, the General Staff placed the Sanitary Corps' Field Training Section under the Corps of Engineers.



Recruits undergoing a simulated gas attack at a National Army Camp, 1918.

in Washington, DC. In January, 1918, after three months of training in gas warfare and general military subjects, thirty-three of the forty-five officers, together with their British instructors, departed for duty at division training camps. The other twelve went directly to France. Unfortunately,

by January, 1918, six of the thirty U.S. divisions destined to see combat in France had either left the States or had completed training. The men in these units had received no chemical warfare training before embarking for Europe. As for the divisions that did receive some training before shipping overseas, their division gas officers were afterwards assigned to the 473d Engineer Regiment, a stateside administrative holding unit. Thus, the first trained gas officers did not deploy with the men they had trained. Although necessary for the training of subsequent divisions, this decision had, in the words of one gas officer, a "discouraging effect upon the men and upon gas training and discipline in general" in the unit deployed overseas. The confidence of the embarking troops was hardly bolstered when the "experts" on chemical warfare stayed home.

As the war progressed, the training in the division camps improved. In January, 1918, the 29th Division's gas training at Camp McClellan consisted of a brief lecture and gas mask drill for one hour daily, five days a week, under the close supervision of British instructors. This compared favorably to the weekly one-hour "anti-gas instruction" in October, 1917. As training became more sophisticated, men underwent tests at the end of their division's training cycle. They masked and entered a chamber filled with chlorine gas. Next, they went through a chamber filled with a tear agent, where they unmasked. Although by the summer of 1918, recruits received standardized chemical warfare training, reports filed by division gas officers in Europe indicated the key to successful preparation had yet to be found. Still more training was needed, and it had to be integrated with other subjects.[21]

In the summer of 1918, with news reaching America of Germany's increased use of gas, an Army regulation was promulgated, requiring every doughboy who left the country to have a certificate indicating he had completed gas training. No other military skill required such validation. Unfortunately, the requirement was usually ignored, and most men continued to arrive in France without the benefit of adequate instruction in gas defense. Gas officers realized that sufficient time for training in the camps did not exist. To make up for the deficiency, units attempted to use the time aboard transports for defensive gas training. The 80th Division, for example, ordered that shipboard activities would include physical training, manual of arms, guard duty, and "anti-gas instruction."[22]

Although the U.S. Army's first efforts in chemical warfare were directed toward "anti-gas" or defensive measures, the development of the means to retaliate in kind soon followed. On 15 August 1917, with the approval of the General Staff in Washington, AEF General Order 108 authorized the organization of special and technical engineer troops that would be assigned to each army as a "Gas and Flame" Regiment.* The War Department ordered recruits for the newly formed 30th Engineers to report to the American University campus in Washington, DC, where they were transformed into

*"Flame" disappeared from the name and from use when GHQ, AEF, decided that the primitive flamethrowers used by the British and the French were more dangerous to the operator than to the enemy.

the 1st Gas Regiment. Unfortunately, with no one to instruct them in offensive or even defensive gas warfare, the only training the first companies of the gas regiment received in the United States involved close order drill. The unit underwent no special training in gas warfare. Beginning in December, 1917, the companies of the 1st Gas Regiment left the United States without gas masks.[23]

Recruits at Camp Kearney, California, using British Ayrton or trench fans to clear gas, 1918.

The gas mask problem continued to plague the Army as a whole. An effective American mask was eventually developed using the British Small Box Respirator as a model. However, production of American gas masks peaked just one month prior to the end of the war. Late delivery and the initial small number of masks produced were offset only by the AEF's decision to purchase several million British and French gas masks.[24]

The same unpreparedness and production lag applied to offensive chemical weapons. The Army attempted to contract out the production of war gases to a number of civilian chemical companies, but these firms objected immediately to the contracts because of the inherent dangers in the production of large quantities of war gases and because the demand

for the product would not extend beyond the conflict. Besides that, the firms had already overcommitted their plants and personnel for the production of other war-related chemical products.[25]

The Army thus found itself with no alternative but to construct its own production facilities. In December, 1917, construction of plants to produce chemical agents began at Gunpowder Neck, Maryland. By the summer of 1918, the Edgewood Arsenal there had plants in operation producing phosgene, chloropicrin, mustard, chlorine, and sulfur trichloride. The arsenal also had a capability for filling artillery shells, although most of the agents produced were shipped overseas to the Allies in fifty-five gallon drums. Because of insufficient time, not one single gas shell manufactured at the arsenal ever reached an American artillery piece in France. When production of chemicals finally peaked one month prior to the Armistice, the plants had to stop production for lack of shell casings. AEF artillery units and special gas troops fired American produced war gas, but in French and British shells.[26]

As the emphasis on chemical warfare increased, there arose a need to coordinate the various agencies assigned responsibility for gas warfare. Accordingly, on 28 June 1918 President Wilson, using the authority given to him by the Overman Act,* ordered the establishment of the Chemical Warfare Service (CWS) as a separate branch of the National Army. Immediately, all activities pertaining to chemical warfare were placed under Maj. Gen. William L. Sibert, formerly Commanding General of the First Infantry Division. The creation of a branch of the Army dedicated to chemical warfare was significant because it acknowledged, albeit belatedly, the tremendous impact the new weapon was having on the AEF.[27]

The CWS, with the concurrence of the General Staff, established ten subordinate divisions:

- Administration
- Research
- Gas Defense
- Gas Offense (Edgewood Arsenal)
- Development
- Proving
- Medical
- Training
- Overseas (Gas Service, AEF)
- 1st Gas Regiment

With the exception of the Overseas Division and the 1st Gas Regiment, the division chiefs were located in Washington, DC, and the operations of their divisions were scattered throughout the United States. The Administration Division facilitated routine matters and coordinated the activities of the other CWS divisions. A Research Division, as the name implied, handled all basic research, from the discovery of new chemicals to the development of protective masks and offensive equipment. Another division, Gas Defense,

*The Overman Act of 20 May 1917 gave the president the authority to reorganize executive agencies during the war emergency.

conducted research, but primarily administered the manufacturing, testing, and inspecting of gas masks for men and animals. This division also had the responsibility for manufacturing gas-proof dugout blankets, protective suits and gloves, antigas ointment, and "gas warning" signals. The Gas Defense Division administered Edgewood Arsenal. A Development Division experimented with charcoal suitable for gas mask filters, a manufacturing process for mustard, and a means of producing casings and adapters for 75-mm shells of similar design to the French glass-lined gas projectiles. A Proving Division tested prototype gas shells before production and spot-tested shells prior to shipment overseas. The Medical Division coordinated work on the therapy, pharmacology, physiology, and pathology of war gases on the body. This division's primary emphasis was on the prevention and treatment of casualties from mustard gas.[28]

The agency that had its most direct impact on the AEF was the Chemical Warfare Service's Training Division. The division's responsibilities included the organization and training of gas troops, the training of "casual detachments for overseas duty," the maintenance of a Chemical Warfare Training Camp detachment, and the procurement and training of chemical officers for overseas duty. In recognition of the division's importance, the Assistant Director of the Chemical Warfare Service, Brig. Gen. H. C. Newcomer, assumed operational command. This was the only division, other than Administration, headed by a general officer.

The structure of the CWS in the United States was determined by the personnel and equipment requirements of the AEF. Stateside training and preparations for chemical warfare had to be curtailed in order to rush American troops to France. Initially, expertise in chemical warfare was lacking. As a consequence, combat divisions deployed without proper training, equipment, and leadership. Until late 1917, there was no chemical warfare doctrine to rely upon. Nevertheless, American troops had to fight on a chemical battlefield against an opponent highly skilled in the use of chemicals in combat. Out of necessity it fell to the Overseas Division, CWS, to bear the brunt of the responsibility for preparing American soldiers for chemical warfare.

The majority of the thirty AEF divisions to see combat in World War I entered the line during and after the five German spring offensives of 1918. These offensives saw chemical warfare at the highest level since its introduction three years before. Regardless of the emphasis eventually placed on gas warfare by GHQ, AEF, and the Army General Staff, new doctrine for gas weapons could not be fully absorbed or mastered by the inexperienced Americans. Prewar neglect of gas warfare equipment and accompanying doctrine had a significant impact on the ability of the AEF to defend against, and to successfully employ, chemical agents in World War I.

The AEF Organizes for Chemical Warfare

4

On 13 June 1917, while the General Staff in the United States struggled to organize, man, and equip an army, General John J. Pershing, Commander of the American Expeditionary Forces (AEF), arrived in France with a staff of fifty-three officers and 146 enlisted men. After a continuous round of official visits and ceremonies, Pershing and his staff settled into temporary headquarters in Paris. Two weeks later the first American troops arrived in France. General Order 8, published on 5 July 1917, established the organization of the AEF General Headquarters (GHQ). This order also created on paper the GHQ position of "Chief of the Gas Service," whose responsibilities included procurement of gas personnel and supplies, the "conduct of the entire Gas and Flame Service both offense and defense," the supervision of training for gas officers and troops, and experimentation with new gases, delivery systems, and protective devices.[1]

Ordering the creation of a Gas Service was a simple matter. The actual organizing of a new branch of the Army, however, would take a tremendous amount of effort and time. Time was precious. By mid-July, over 12,000 doughboys were within thirty miles of the front, all without gas masks or training in chemical warfare. Yet, because of more pressing problems,* it was not until 17 August 1917 that General Pershing sent a cable to Washington requesting the organization of a Gas Service and the authority to appoint Lt. Col. Amos A. Fries, Corps of Engineers, as its chief.

Lieutenant Colonel Fries had arrived in France three days earlier. As an engineer officer he was assigned responsibility for organizing a road network to support the AEF Services of Supply (SOS). Several days later Col. Hugh A. Drum and Col. Alvin B. Barber of the GHQ, AEF, approached Fries. As Fries recalled after the war, the staff officers asked what "I should think if my orders were changed so as to make me Chief of the newly proposed gas service." Given overnight to decide, Fries accepted. On 22 August 1917 he began to build an organization based on information Barber and Drum had compiled about the British Special Brigade and French "Z"

*In addition to commanding an army in a combat zone, Pershing was faced with the same problems that the General Staff in Washington had—the officering, billeting, feeding, equipping, and training of a vast army of raw recruits.

units. In addition, the staff officers gave Fries a draft of a proposed General Order 31 that would establish a Gas Service.[2]

General Order 31 assigned the Gas Service responsibility for both offensive and defensive operations, including the organization of gas personnel, gas warfare supplies, and gas warfare training in the AEF. Appended to the order was a draft chart of the Gas Service Organization. In reviewing the chart with Fries, Pershing noted that the offensive arm included Stokes mortar companies. This prompted him to ask why existing trench mortar companies could not be utilized to fire gas rounds. Barber and Drum, who were also present, explained that gas operations were too technical and dangerous for untrained personnel to conduct and, therefore, required special troops. They also told Pershing that in the British Army the Special Brigade used 4-inch Stokes mortars.[3]

Acting on Pershing's instructions, Fries, with Colonel Church and Captain Boothby of the Medical Department, visited the British Special Brigade headquarters at St.Omer. Church had served as an observer with the French Army for a year and a half and, during that time, had collected information on chemical warfare defense. Boothby did the same while observing British chemical warfare procedures and also took a course at the British defense school. At St.Omer the medical officers discussed British defensive gas doctrine, while Fries obtained information on the offensive aspects of chemical warfare. Fries elicited information on gases in use, special troops, chemical ammunition, and delivery systems. He also visited the large chemical material depot for the British Fifth Army.

After returning to AEF headquarters, the three officers reviewed both the draft General Order and the organizational chart. They modified the original proposals to provide general rather than specific guidelines, anticipating that only actual combat experience would glean the information necessary to build a truly effective organization. Fries criticized the British system that divided responsibility for offensive and defensive gas warfare. Paradoxically, the British liaison officer in the United States, Maj. S. M. J. Auld, warned the Americans against just such a practice. Thus, the AEF Gas Service made it the responsibility of all gas officers to be knowledgeable in both areas, a point driven home in subsequent general orders detailing the duties of army, corps, and division gas officers. On 3 September 1917, almost five months after the United States entered the war, the final version of General Order 31 was published (Figure 2).[4]

Not until 27 May 1918, as U.S. divisions were coming on-line in increasing numbers and experiencing heavy gas casualties, did GHQ, AEF, issue General Order 79 for the establishment of unit gas officers. Only then did Fries have the authority to appoint chief gas officers for armies and corps and gas officers and assistants for divisions. Until this time, division commanders had been appointing gas officers as they saw fit. Under the new arrangements, chief gas officers of armies and corps and division gas officers would be staff officers responsible to the commander. Parallel reporting procedures were established in order to ensure that accurate information

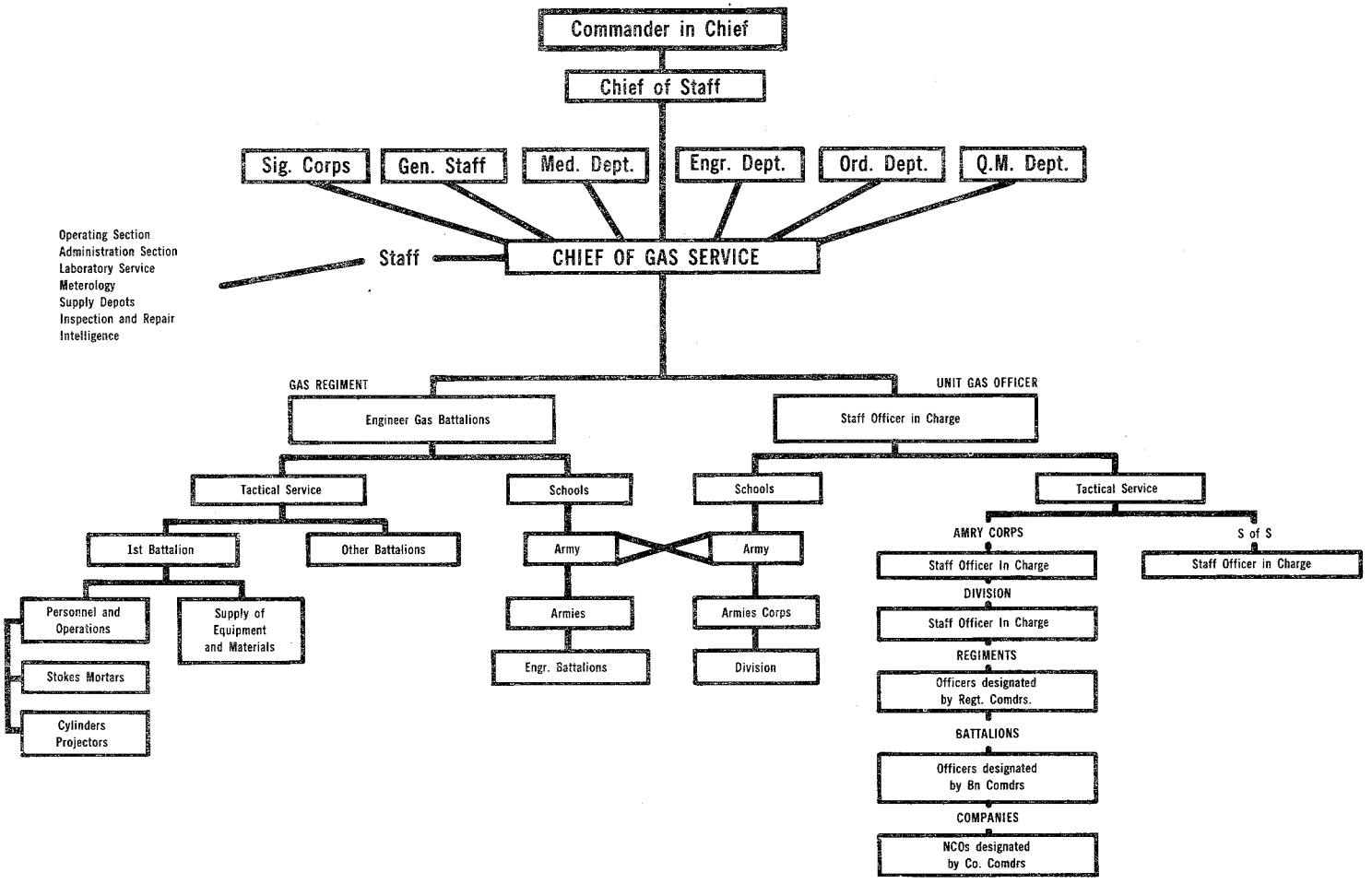


Figure 2. Organization of the Gas Service, AEF, 1917.

reached the proper authorities. In addition to reports through official channels, the order authorized these officers to send required reports directly to the Chief of the Gas Service. The Chief, with GHQ approval, could also order these unit staff officers to attend meetings necessary for the coordination of defensive gas measures.

The division and higher echelon gas officers had specific duties assigned. By direction of their commanding officers, they were to instruct and supervise the gas officers and NCOs within their command, supervise all defensive training and drill, collect enemy chemical warfare material for submission to AEF laboratories, inspect defensive measures, and advise the commander and staff regarding all aspects of chemical warfare. The division gas officer had the responsibility of reporting to the commander all gas casualties and actions taken to prevent recurrences. The division commander forwarded this report, together with a list of the actions he had taken to correct the deficiencies, to the Chief of the Gas Service.

Regimental and battalion commanders assigned duties to their gas officers. At this level, gas officer and gas NCO responsibilities were considered additional, not primary duties. A gas officer and NCO assistant were required for regiment, battalion, and separate units, and two NCOs were appointed for each company. Selected on the basis of undefined "special qualifications," the men were trained at the AEF Gas Defense School or corps gas schools. Among their duties, they supervised training in the use of gas masks, gas proof shelters, alarm systems, and related defensive measures. When the division entered combat, the gas NCOs were required to inspect all defensive equipment and antigas procedures at least twice a week. They reported weather, terrain conditions, all new enemy gas tactics and material, and any noted deficiencies. This information was reported officially to the company commander and informally to the battalion commander.

General Order 79 established an AEF Gas Defense School with a course of instruction "adequate for the training in gas defense of gas officers and noncommissioned officers." The school director received specific instructions to coordinate his activities with those of officers engaged in offensive gas instruction and with those at the AEF's new chemical experimental station at Hanlon Field near Chaumont. Instructors at the Gas Defense School kept abreast of the latest changes in gas warfare by personally reviewing files of Allied and American gas officer reports and by reading translated copies of captured German and Austrian documents.

General Order 79 dealt primarily with the Gas Corps* and the training of its officers, but it also called the attention of "all ranks" to the "increasing importance of gas warfare." Although the Gas Corps would do everything that was possible to prepare individuals and units to avoid casualties from gas, the "ultimate responsibility" for defense against gas, the order concluded, "devolves upon commanding officers" who must provide for the training of their men and the maintenance of gas discipline. In order to

*Gas Service and Gas Corps were terms used interchangeably in the AEF.

maintain gas discipline and provide adequate training, the order urged commanders to cooperate with Gas Corps officers.[5]

The extensive use of gas by the Germans in their spring 1918 offensives caused the AEF General Staff to expand the duties of gas officers. As of 2 July 1918, gas officers were to be consulted and their technical knowledge utilized in the preparation of all plans involving the extensive use of gas, whether by artillery or other means. Thus, the duties and responsibilities of gas officers grew with the increasing awareness of the impact chemical agents were having on the offensive and defensive capabilities of AEF units. Fries, however, faced a chronic problem of locating competent men to serve in a branch of service that lacked precedent and had an unknown future. This was further complicated by an Armywide shortage of personnel. The Corps of Engineers, originally the primary source of gas officers, became reluctant, as its own demand for officers grew, to have men reassigned to another branch.[6]

The AEF Gas Service had other problems with which to contend. There was, for example, a severe shortage of gas warfare supplies. The lack of protective masks for members of the AEF caused the greatest concern. On 2 August 1917, GHQ, AEF decided to utilize the British Small Box Respirator (SBR) as its primary mask and the French M-2 mask* as an "emergency" protective device.[7]

The SBR consisted of a canister-type filter of absorbent charcoal with alternating layers of oxidized soda lime granules. A flexible rubber tube connected the canister to a rubberized facepiece that was held to the face by elastic bands in order to provide an airtight fit. Inside the facepiece was a rubber nose clip. A hard rubber mouthpiece that the wearer grasped by his teeth was connected to the flexible hose attached to the filtration canister. A soldier exhaled air through a rubber flutter valve at the front of the mask. The wearer viewed the world through two lenses made of celluloid or specially prepared glass. Each soldier had a tube of "anti-dimming" or defogging paste that could be used to prevent condensation from forming on the lenses. Lacking an American mask, the AEF placed an initial order for 600,000 SBRs and 100,000 French M-2 masks. Additional orders followed, as it would take the United States a year from its entry into the war to begin providing its troops in the field with an acceptable American-made version of the SBR.[8]

The shortage of respirators notwithstanding, no individual could enter the combat zone unless equipped with a mask. Commanders and staff officers went to considerable lengths to ensure that all members of their units had respirators. In late December, 1917, the newly arrived 42nd "Rainbow" Division was moved by rail to a training site in France. On the train were masks for the unit, which the division's Chief of Staff planned to issue on its arrival. The 1st Division, however, was due to go "on the

*Because of its poor filtration capability and flimsy construction, the M-2 mask was later banned for use in the alert zone for everyone except men with head wounds who could not wear the SBR, men who were unconscious and could not grasp the mouthpiece, and black soldiers who could not wear the nose clips of the SBR.

line shortly" and submitted an urgent request for respirators. The Chief of the Gas Service responded by ordering the 42nd's Chief of Staff to transfer his masks to the 1st Division. To circumvent the order, the 42nd's Chief of Staff immediately stopped the train and ordered the masks issued to his men. He then reported to Fries that it was impossible to comply with the order because the masks had already been issued.[9]

Several thousand men of the 1st Division lacked masks, and its 1st Brigade was scheduled to move to the front line in January.* Fries finally obtained a "priority of shipment" and detailed several gas officers to accompany the masks from Le Havre, the major British supply base, to ensure their safe delivery to the 1st Division. Despite these precautions, one carload of 4,000 masks disappeared in transit. Fries finally had to order the 2nd Brigade of the 1st Division to turn in their SBRs. These were cleaned and reissued to the Division's 1st Brigade. This episode was not an isolated one.[10]

Gas equipment and supplies in the United States and France were initially the responsibility of the nearest related branch of the Army. The AEF Gas Service found this procedure "exceedingly embarrassing, cumbersome and inefficient." Despite initial resistance, the General Staff in Washington approved AEF requisition submitted on 10 September 1917 for 50,000 cylinders, 50,000 Livens projector shells, and a large quantity of Stokes mortars and ammunition. None of these weapons or ammunition reached the AEF in time to be used in combat. To avoid duplication of effort and to save time, Fries, in February, 1918, received permission to make direct purchases of equipment from the Allies. At that time almost all of the gas warfare material used by the AEF came from the British. Not until April, 1918, did any material manufactured in the United States begin to reach the AEF. As noted in the preceding chapter, a number of war gases were manufactured in the United States during the war, and more than 3,600 tons of these did reach the French and British.[11]

Because of a shortage of artillery pieces, artillery units of the AEF were equipped primarily with the French 75-mm light field gun, the 155-mm medium howitzer, and the 240-mm heavy howitzer, as well as with British 8-inch and 9.2-inch heavy howitzers. The U.S. Army also adopted, with minor modifications, the French gas shell. The AEF Services of Supply purchased French shells and painted them according to an American color code.**[12]

Originally, the SOS defensive gas equipment fell into Class I with clothing, leather goods, and optical instruments. In February, 1918, when the Gas Service was given authority to requisition its own supplies, all

*Only one-half of the 1st Division was needed to relieve a French division (French divisions were one-half the size of the comparable American unit). The balance of the 1st Division remained in training.

**They were distinguished by a gray body lettered "Special Gas." A strip colored either white or red or both circled the shell. Nonpersistent gas had only red, semipersistent gas combined red and white. The number of stripes indicated the relative persistency, the least persistent having fewer stripes.

items of gas warfare equipment were placed into a new category, Class V. In September, 1918, the Army created four subclasses within the general Class V classification. Subclass A material included offensive gas supplies, such as gas shells and grenades, that were not used by gas troops but by the combat arms. Subclass B material included those gas supplies issued exclusively to gas troops. Subclass C supplies encompassed aviation, smoke, and incendiary material. Subclass D items included all defensive gas material. The Ordnance Corps transported and issued subclasses A and C, while the Gas Service did the same for B and D items. The Gas Service distributed all "anti-gas supplies." Fries ordered a 10 percent reserve of all equipment at the division gas dumps, and each company or regiment maintained a 5 percent reserve supply. The division gas officer issued the required masks to the regimental supply officers, who distributed them to battalions. Gas officers also issued gas alarm devices, Strombo horns, Klaxon horns, and gongs directly to company commanders in each sector. Later, army and corps gas officers were given similar responsibility for the issue of gas supplies to corps artillerymen and all rear echelon troops.[13]

Another branch heavily involved in chemical warfare was the Army's Medical Department. The General Staff anticipated that medical officers would require some knowledge of the actual symptoms brought on by chemical agents and the various methods of treatment for gas poisoning. Consequently, in May, 1917, the War Department issued a "Memorandum on Gas Poisoning in Warfare with Notes on Its Pathology and Treatment," based on British sources. Still, despite this assistance from Washington, most of the planning and organization for the treatment of gas casualties was done by the AEF in France.[14]

Maj. J. R. Church, Medical Department, was the first Medical Director of the Gas Service in France. While on the General Staff, he had assisted in the initial planning for an AEF Gas Service. As Medical Director he devoted most of his time to organizational matters. The increase in gas casualties, however, resulted in a personnel change in the position, with Lt. Col. Harry L. Gilchrist, M.D., the former commander of Number 9, General Hospital, replacing Church. Gilchrist prepared for his new assignment by attending the British Gas School at Rouen, France.[15]

When Gilchrist reported for duty as Medical Director, he found no records or guidelines detailing the responsibilities of his position. His first priority, and one agreed to by Fries, was to launch a gas instruction campaign directed specifically at AEF medical officers. On 9 February 1918, Gilchrist published a pamphlet, "Symptomology, Pathology and General Treatment of Gas Cases," which provided medical officers basic information on the treatment of chemical casualties. Following this publication, the Medical Director's office issued a constant stream of bulletins aimed at keeping AEF medical officers up-to-date on the latest medical developments in gas warfare. Gilchrist visited most AEF divisions and hospitals, where he lectured to officers and men on chemical warfare from a medical point of view, emphasizing prevention and treatment of gas casualties.[16]

As the chemical war escalated with the introduction of mustard gas, the Medical Director's responsibilities and, indeed, his department's tasks became increasingly crucial to the AEF. Gilchrist inspected troops at the front and visited medical personnel in hospitals, hospital trains, and other locations. He also served as the liaison officer between the Gas Service and the Medical Department, advising both the AEF's Chief of the Gas Service and the Chief Surgeon on gas-related medical matters. In addition to these general duties, he collected all medical information relating to gas warfare and relayed it to the AEF's Chief Surgeon. Gilchrist focused his attention on such matters as new treatment for gas casualties and "combating the effects of the enemy gases not only from a therapeutic, but also from a prophylactic point of view." To obtain information, he visited the sites of battles where large numbers of gas casualties had occurred.[17]

Because armies and corps of the AEF were formed after the arrival of a number of divisions, the medical structure to treat gas casualties evolved first within the division. On 1 March 1918, the 42nd Division became the second American division to occupy a sector on the Western Front. Although initially the division had few gas casualties, the medical officers prepared for a large influx of gas victims. All four of the division's field hospitals were set up to accept gas victims, and orders were given that a total of 500 beds be put aside for such cases. On 20 March the Germans launched an artillery bombardment of mustard and high explosive shells that hit the 42nd Division's 165th Infantry at 1730 hours. In the space of a few minutes, the mustard caused 270 casualties, including one death. The first-aid station through which the casualties passed also received a drenching with gas, so medical personnel wore masks as they treated the patients.[18]

As a result of this attack and others that followed, the 42nd Division took several steps to improve the treatment of gas casualties. These later became standard for AEF divisions in the line. The first measure was to dedicate one of the four division field hospitals to gas cases. The position of division Gas Medical Officer was also created. Memorandum 148, HQ, 42nd Division, published on 23 April 1918, listed the duties of this officer as the instruction of medical personnel in gas defense; the supervision of gas protection of medical dugouts, aid stations, and field hospitals; the early diagnosis of symptoms; and the treatment of all types of gas casualties.[19]

The AEF adopted the 42nd Division's practices when it instituted the position of division Gas Medical Officer in AEF General Order 144, dated 29 August 1918. GHQ took this measure in the face of mounting gas casualties and a high incident of gas malingering. As a consequence, in addition to the duties indicated in the 42nd Division's memorandum, the AEF order added duties such as the instruction of all division personnel on the early symptoms and treatments of gas poisoning and the instruction of line officers in practical medical matters connected with gas warfare. The orders stated that any officers selected must be "live, wide-awake, energetic men, and must show a keen appreciation of the work." By the first week in October, 1918, each AEF division had a Gas Medical Officer. These men

were sent to the School of Pharmacy's School of Gas (*Ecole de Gaz*) at the University of Paris for a four-day course to prepare them for their division duties.[20]

Beyond the division field hospitals, each army established its own gas hospitals.* The first such installation began operation on 29 August 1918. Army-level hospital personnel were casuals, or officers and men loaned from base or evacuation hospitals or anywhere else medical personnel could be found. To meet the demands of the Meuse-Argonne offensive, the Chief Surgeon, AEF, in September, 1918, established five gas hospitals with a total of 1,650 beds. Colonel Gilchrist suggested three mobile 1,500-bed gas hospitals be established, one for each U.S. corps. This plan, however, was never implemented because of insufficient personnel. Another plan called for the creation of two "emergency gas teams" to be assigned to each base hospital. Their mission was to "relieve the strain" that sudden gas attacks put on division field hospitals. The GHQ, AEF, organized several "emergency gas teams," each consisting of a medical officer, two nurses, and two orderlies. The Chief Surgeon of the 1st U.S. Army, Col. A. N. Stark, however, objected to these teams on the grounds that base hospitals were too far removed from the fighting. He also believed that the division field hospitals set aside for gassed soldiers were effective and needed no further assistance. Heeding Stark's objections, the Chief Surgeon disbanded the teams.[21]

Another problem with which Fries and his staff had to contend was training in gas defense. When the 1st Division arrived in France, Pershing thought it best to have the Americans train by serving with a French division. This proved to be unsatisfactory because the training varied from unit to unit within the French division. When the Training Section of the AEF's GHQ became operational, it prepared a standardized division training schedule. Initially, the period of time a division spent preparing to enter the line was supposed to be three months.** Only two days of the schedule were allocated to Gas Service instructors. Later, as the demand for combat units increased, the gas instruction decreased to a mere six hours. This was vigorously protested by the Gas Service. In the spring of 1918, when the German offensives required a shortening of the division training cycle to bring new units on line, gas instruction was cut further.[22]

Formal defensive training was supplemented by wearing the masks during other training activities. Pvt. Norman A. Dunham of the 40th Division remembered wearing the SBR and full pack during two- and three-hour marches. He thought the mask "the worst thing a soldier has to contend with" and the "most torturous thing" a person can wear. Lt. Edgar D. Gilman remarked that when he wore the mask he found that it was not only disagreeable, painful, and smothering, but also that his saliva flowed profusely from his mouth, through the flutter valves, and down the front of

*Corps hospitals were not considered because a corps was organized exclusively for tactical purposes.

**The 1st Division was retrained at Gondrecourt and was the only AEF Division to complete the AEF's three-month-long training schedule.

his shirt. Personal protection was essential for survival on the battlefield, however, and command emphasis had to be placed on defensive gas training, to include the wearing of the mask.[23]

It became obvious to GHQ, AEF that many commanders were not supporting the training activities of their gas officers and NCOs. To remedy this problem, officers in brigades that were rotated off the line received a comprehensive lecture course on gas defensive measures. However, continued reports of over 25 percent gas casualties indicated to the General Staff that, after basic training, comparatively little was to be gained by instructing individuals in units on the line. The consensus among gas officers was that training had to instill an interest and awareness of gas defensive measures throughout an entire unit to give the best results in combat. Gas officers also believed more realistic training was needed. One result of this conviction was that artillery batteries, when they trained, received a minimum of three surprise gas attacks as part of the training schedule. To test the alertness of sentries and to correct such carelessness as leaving masks out of reach, attacks were often scheduled at night, while the troops were sleeping at their position. Men firing on the ranges were subjected to simulated surprise gas attacks in order to familiarize them with laying artillery pieces during an attack and to acquaint them with the difficulty of transmitting firing data while masked. During night marches, men were subjected to gas attacks as a means of teaching them to overcome confusion.

During the first year of American participation in the war, men arriving as individual replacements had little or no formal instruction in defensive measures until they reached their units in the forward areas. In the summer of 1918, the Army acted to rectify this haphazard method. Training stations were established at the AEF debarkation ports of Brest and St.-Nazaire. Each center had five Gas Service instructors: one officer and four NCOs. Three enlisted men acted as gas mask fitters and helpers. When troops arrived at the stations, they marched single file into a warehouse to be fitted and issued masks. After an inspection, the troops moved to a large lecture hall where instructors did everything possible to impress on the men the importance of defensive gas measures. To complete the training, seventy-five to 100 men at a time entered a gas chamber filled with a tear agent for five to ten minutes. At peak times more than 2,000 men a day were put through this initiation into gas warfare.

In Army rear areas, depot divisions,* such as the one at La Querche, handled three categories of personnel: newly arrived line replacements, special units such as engineer troops, and casuals who were recently released from hospitals and scheduled to rejoin their units. During the normal three-week course, the replacements received a minimum of eighteen hours of gas defense training. Their training consisted of lectures, mask drills, games with the mask worn, and firing weapons while wearing the

*The AEF suffered so many casualties that some divisions were broken up, their men used as replacements, and their cadre used to train arriving personnel.

SBR. The troops also went through simulated tactical operations, with the instructors lighting smoke candles and throwing tear gas grenades to provide added realism.

Special troops such as pioneer infantry, engineer, and medical service units first received basic infantry training and then were given three days' intensive instruction in gas defense. During the three days, the men practiced their specialty while wearing masks. For example, medics with SBRs in place applied bandages and carried stretchers through woods and over rough terrain. Engineers constructed roads and pioneer troops dug ditches while wearing masks. After duty hours, trainees played baseball in their SBRs.

Hospital convalescents, the last category of men run through the depot divisions, numbered anywhere from a handful to 2,000 a day. These men were reequipped with masks, and those with prior gas training—Class "A" men—were excused from formal instruction until August, 1918, when the mounting number of mustard gas casualties compelled the Gas Service staff to give all personnel short classes on ways to avoid being contaminated by this persistent agent.

Sanitary Detachment, 121st Machine Gun Battalion, wearing the SBR while playing baseball, 2 June 1918.

The increased German employment of chemical agents—especially mustard gas—for counterbattery fire forced American artillery training camps to place special emphasis on defensive gas instruction. During a gas attack, a poorly trained artillery man would be totally incapable of serving his weapon or delivering accurate fire. Initially, artillery officers and NCOs attended a week-long course of lectures, drills, and practical exercises. Later NCOs received an additional week of training. If the artillerymen failed to score 70 percent or better on the final examination, they had to repeat the course. Just before returning to the front, the graduates had to visit a base hospital to see gas casualties. The experience, according to instructors, "furnished a great stimulus to general gas training." Still, despite these efforts to train every doughboy arriving in France, many received no training in gas warfare because of the pressing need for troops on the front lines.[24]

In conjunction with the emphasis on gas defensive training, the AEF paid increasing attention to the offensive gas capabilities of the American Army in France. On 10 January 1918 the first two companies of the 1st Gas Regiment (30th Engineers) arrived in France (Figure 3). The companies reported to the British Special Brigade training area at Helfaut, where Brigadier General Foulkes personally directed the training of the unit. Eventually, four of the six companies of the regiment passed through Helfaut.

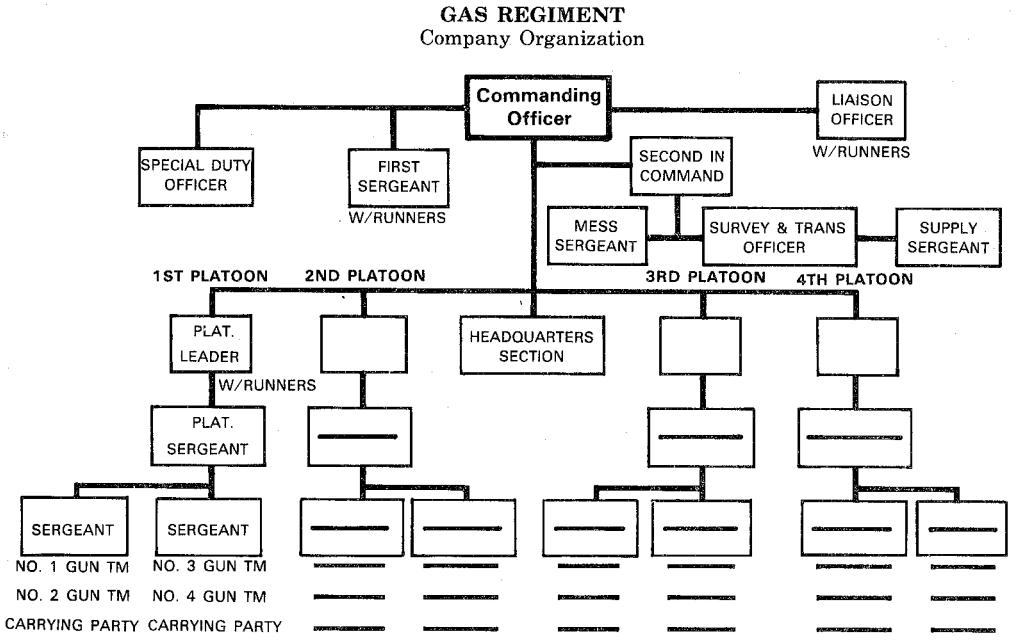


Figure 3. U.S. Gas Regiment, company organization, 1917.

The training of the 1st Gas Regiment in offensive gas operations began in February, 1918, and employed the delivery systems used by the British. The American troops spent five days learning to use Livens projectors, seven days for Stokes mortars, and two days for cylinder operations. The men first attended classes and then conducted practical field exercises in which they applied their newly acquired knowledge. Projector operations called for the emplacement of the guns at night and their detonation the following day. Stokes mortar drill required the men to conduct rapid fire with gas rounds, thermite, and smoke, both day and night. Officers of the regiment opened cylinders of chlorine, and the men walked through the gas cloud to instill confidence in their training and equipment. The American officers were then detailed to a sector of the British front and assigned to Special Brigade companies, where they observed projector, mortar, and cylinder operations. The overall result was that these men better understood offensive gas operations and could assist in training the other companies of the American Gas Regiment.[25]

On 6 June 1918 these trained officers and men held a practice shoot for the AEF General Staff at Hanlon Field, the home of the AEF's Gas School and experimental station in France. Twelve Stokes mortars and 100 Livens projectors were fired. On 22 June, after several more exercises, companies of the 1st Gas Regiment moved to the U.S. sector to conduct offensive gas operations.

Artillery was the other branch of the Army capable of conducting offensive gas operations. In the first gas warfare manuals prepared by the U.S. Army War College, artillery employment was not included because of the continual changes in gas tactical doctrine* on the Western Front. Therefore, almost all artillery training in gas warfare was conducted in France, where the AEF adopted British and French doctrine for gas shell fire. The U.S. 1st Army, for example, published its own "Provisional Instruction for Artillery Officers on the Use of Gas Shell," based on French field manuals. At artillery camps, gas officers lectured on the problems involved in the use of gas shells, but no evidence exists to indicate that gas shells were ever fired in training. Yet, by 1 November 1918, 20 percent of all shells delivered to the AEF were gas filled, and a 25 percent ratio was planned for 1919.[26]

No other preparations or plans were instituted in AEF rear areas to prepare and sustain the American armies in chemical warfare. The burden of the gas war fell to the combat divisions of the AEF. How well they fought and how well they adapted to this new experience is the subject of the next chapter.

*Firing with gas shells was such a new experience that the opposing armies changed their doctrine on a regular basis seeking the most effective means of employment.